Feb. 12, 1929. 1,701,870

R. CONRADER

METHOD OF AND APPARATUS FOR TREATING OIL AND ITS CONSTITUENTS

Filed Oct. 31, 1921 6 Sheets-Sheet 1

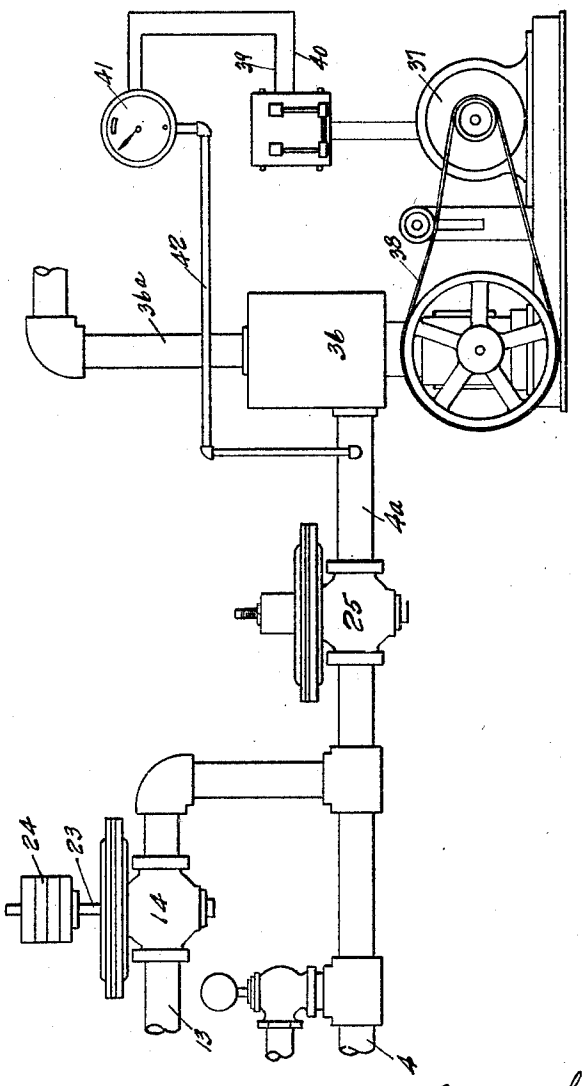


Fig. 1.

Rudolph Conrader
Inventor.

By R. R. Reed
Attorney.

Feb. 12, 1929. 1,701,870

R. CONRADER

METHOD OF AND APPARATUS FOR TREATING OIL AND ITS CONSTITUENTS

Filed Oct. 31, 1921 6 Sheets-Sheet 2

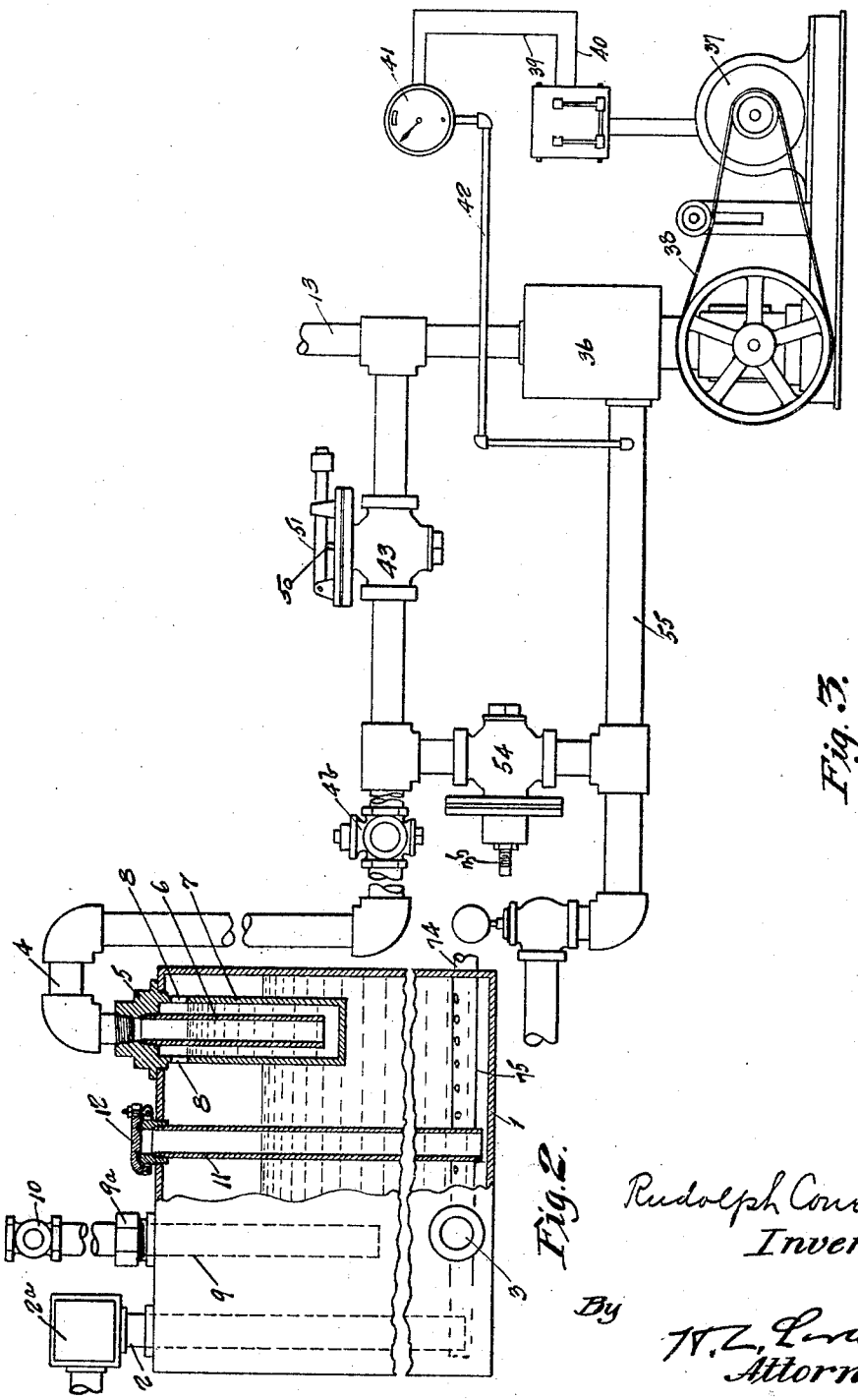


Fig. 2.

Fig. 3.

Rudolph Conrader
Inventor.

By W. L. Ford
Attorney.

Feb. 12, 1929. 1,701,870

R. CONRADER

METHOD OF AND APPARATUS FOR TREATING OIL AND ITS CONSTITUENTS

Filed Oct. 31, 1921 6 Sheets-Sheet 3

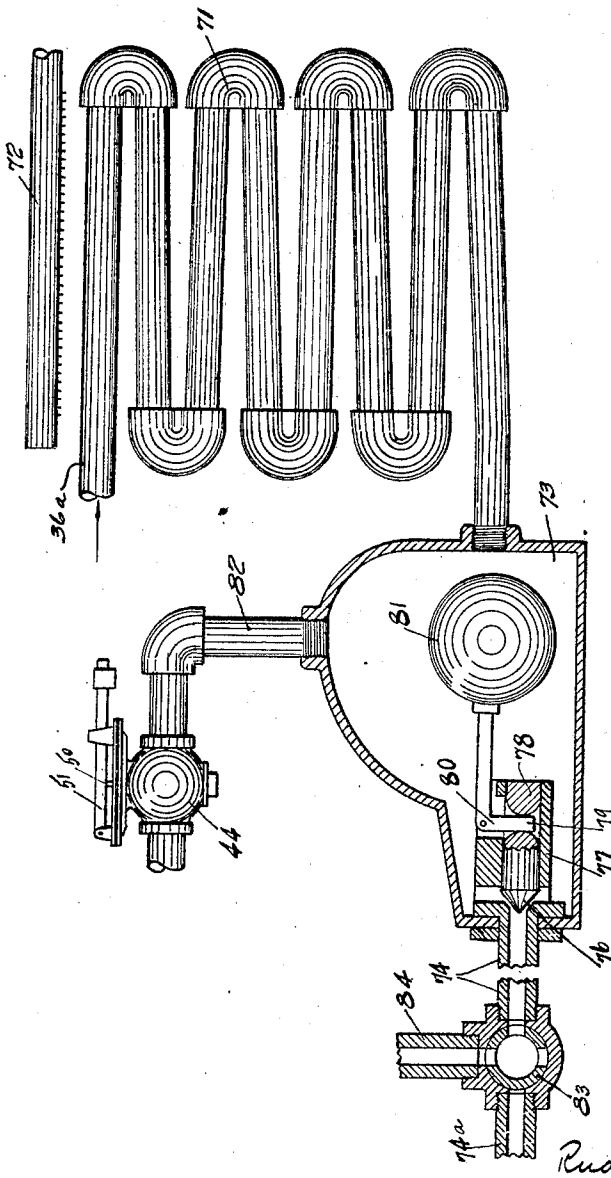


Fig. 4.

Fig. 4a

Rudolph Conrader
Inventor

by W. E. Lord
Attorney

Feb. 12, 1929. 1,701,870

R. CONRADER

METHOD OF AND APPARATUS FOR TREATING OIL AND ITS CONSTITUENTS

Filed Oct. 31, 1921 6 Sheets-Sheet 4

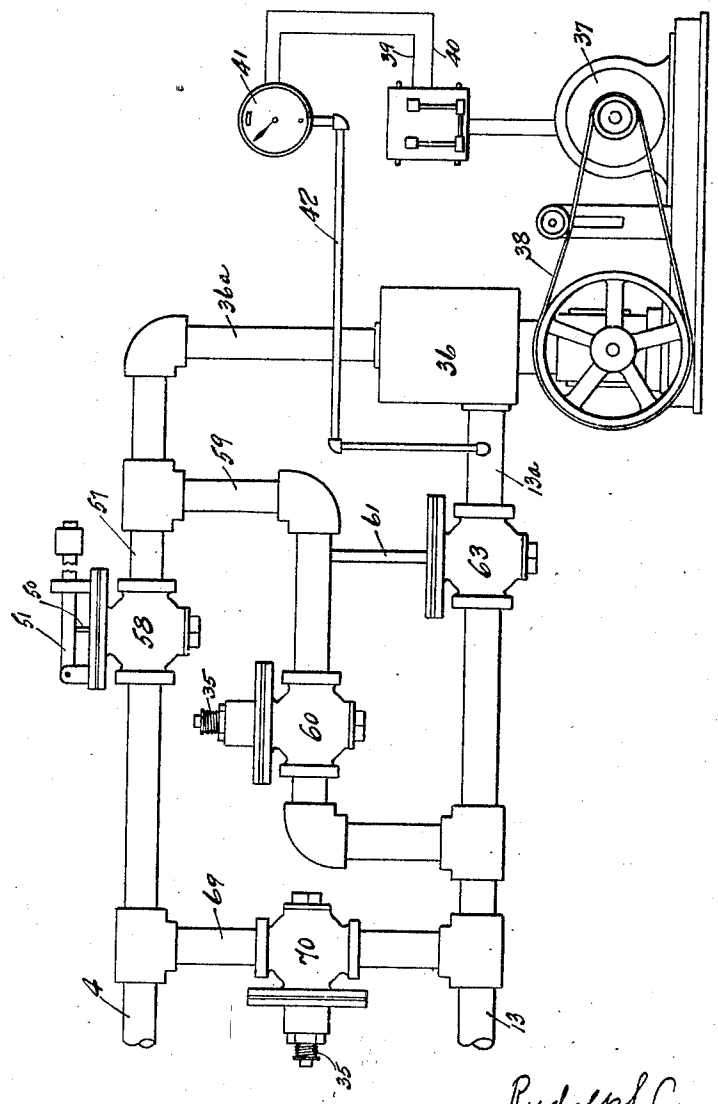


Fig. 5.

Rudolph Conrader
Inventor.

By

Attorney.

Feb. 12, 1929. 1,701,870

R. CONRADER

METHOD OF AND APPARATUS FOR TREATING OIL AND ITS CONSTITUENTS

Filed Oct. 31, 1921 6 Sheets-Sheet 5

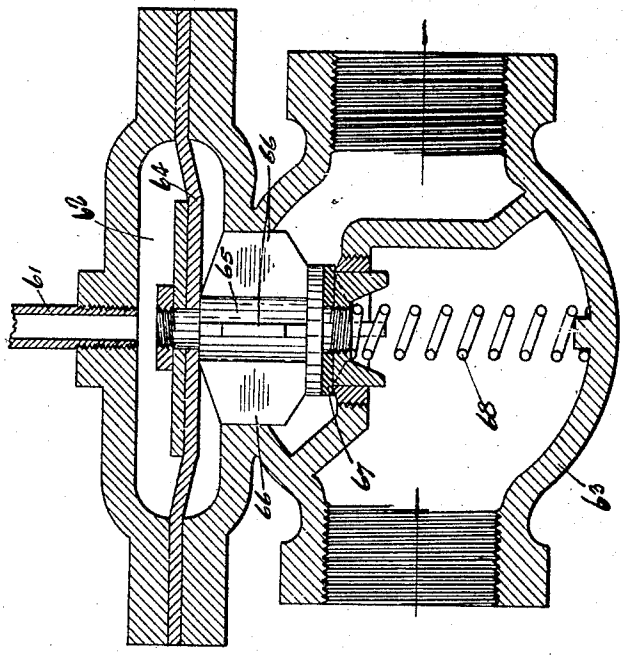


Fig. 7.

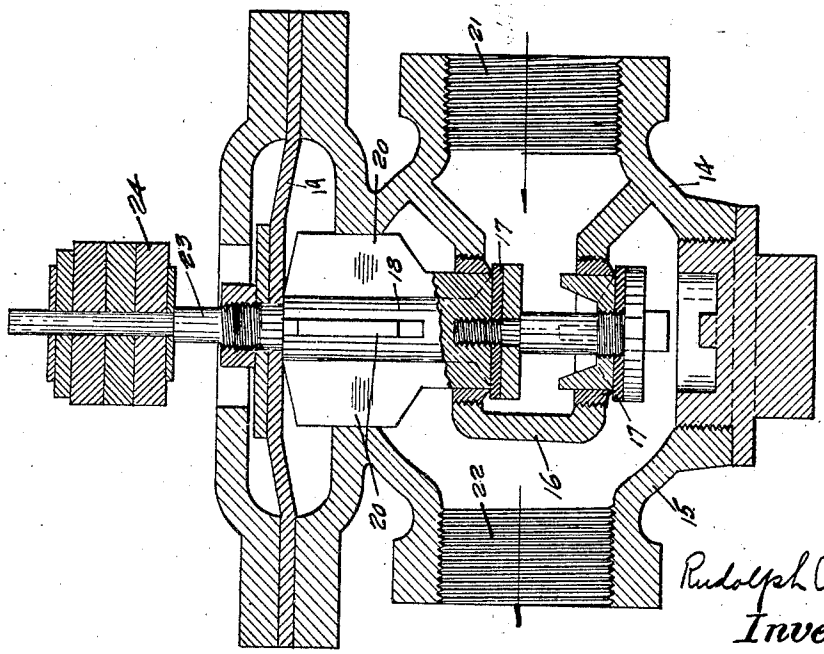


Fig. 6.

Rudolph Conrader
Inventor.

By

A. L. Lund
Attorney.

Feb. 12, 1929. 1,701,870

R. CONRADER

METHOD OF AND APPARATUS FOR TREATING OIL AND ITS CONSTITUENTS

Filed Oct. 31, 1921 6 Sheets-Sheet 6

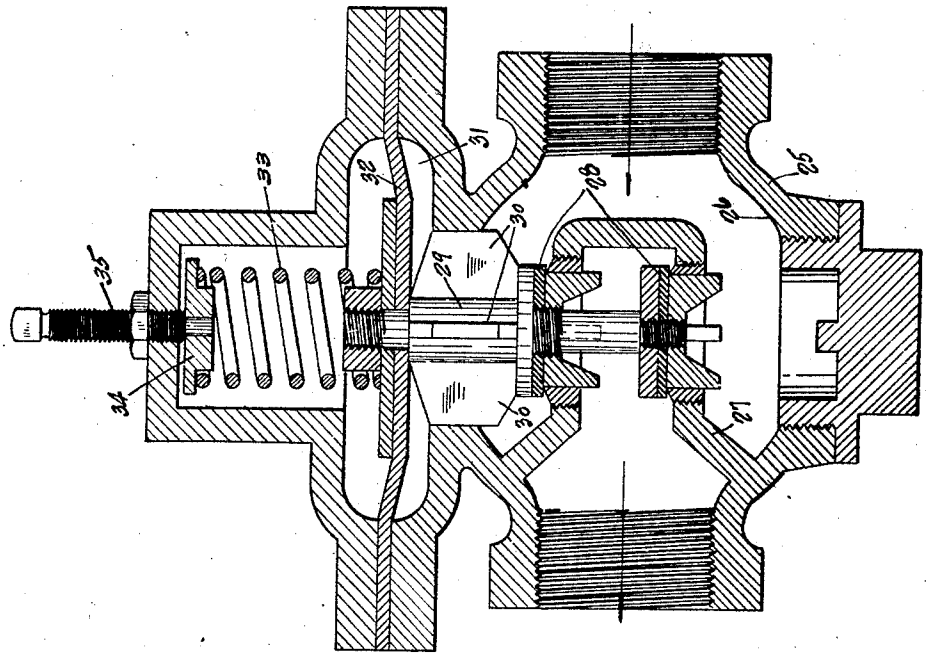


Fig. 9.

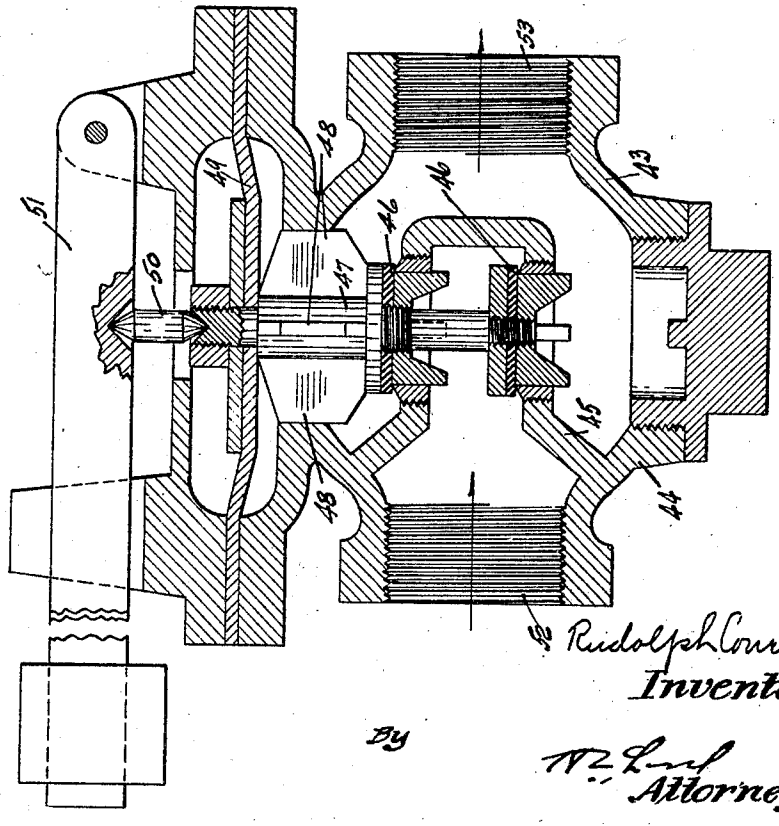


Fig. 8.

Rudolph Conrader.
Inventor

By

Attorney.

Patented Feb. 12, 1929. 1,701,870

UNITED STATES PATENT OFFICE.

RUDOLPH CONRADER, OF ERIE, PENNSYLVANIA.

METHOD OF AND APPARATUS FOR TREATING OIL AND ITS CONSTITUENTS.

Application filed October 31, 1921. Serial No. 511,650.

In handling oil and its products, such as gasoline, particularly where large quantities are stored great losses are sustained by reason of the evaporation of the lighter constituents of the oil, or gasoline, due to variations in temperature and pressures. This is obviated in the present invention to a large extent by maintaining a constant pressure on the oil delivering a sufficient quantity of gas where there is contraction of the oil or gas in the tank or some of the oil of the tank is discharged and drawing off the gas from the tank as it is formed through rising temperatures. These large tanks permit of only slight pressure and consequently as a matter of safety the pressure maintained can be but slight and must be controlled within comparatively narrow limits. It is preferable also to condense the gasoline from the gas especially where gasoline is being stored and to return the liquids so condensed to the main volume of gasoline preferably distributing it so that it may be absorbed in the volume of liquid and thus be retained as a liquid in the gasoline stored.

The apparatus exemplifying the invention and by means of which the method may be carried out is illustrated in the accompanying drawings as follows:—

Fig. 1 shows a view diagrammatically of a piping and pump with controlling device for maintaining pressure on the tank.

Fig. 2 a tank.

Fig. 3 an alternate construction of controlling device.

Fig. 4 a condensing coil for condensing the portion of the gasoline from the gas taken from the tank.

Fig. 4ª a valve designed for use where the gasoline is condensed from oil.

Fig. 5 an alternative construction of control where gas is supplied below the pressure desired on the tank.

Fig. 6 is a valve controlling gas supply under higher pressure than the desired tank pressure.

Figs. 7, 8 and 9 sectional views of controlling valves.

The ordinary storage tank is shown in Fig. 2, 1 indicating the storage tank, 2 the liquid inlet to the tank, 3 a liquid discharge from the tank, and 4 a gas connection for controlling the pressure on the tank, the gas connection being preferably arranged through a trap comprising a fitting 5 with a downwardly extending pipe 6, the pipe 6 projecting into a closed tube 7 having the lateral or radial openings 8 near the top of the tank. By so arranging the gas connection to the tank gas is delivered and taken from the tank without disturbing to any great extent the gas in immediate contact with the liquid, thus reducing the vapors which arise from the liquid. The tank is supplied with a tube 11 for the insertion of the gauge, this tube being closed by a hinged door 12 furnished with a suitable packing to make a tight joint. An air tube 9 leads to near the bottom of the tank and is supplied with a cut-off valve 10, the purpose of the pipe 9 being to facilitate the discharge of air when the tank is being filled with gas over the liquid. With the controlling device as shown in Fig. 1 gas under pressure above that desired in the tank is supplied through a pipe 13. The delivery of this gas is controlled by a controlling valve 14, this valve being shown in detail in Fig. 6. It is provided with a body 15 having a partition 16 with valve openings and seats therein, a valve 17 operating on these seats, the valve having a stem 18, the stem being secured to a diaphragm 19. Guide wings 20 extend along the stem 18. The diaphragm has a stem 23 extending out of the body and this is loaded with a weight 24. The inlet is at 21 and the outlet at 22, the outlet pressure it will be observed acting on the diaphragm and closing the valve as it rises. With an ordinary tank pressure this will close at a very slight pressure above atmosphere, storage tanks as ordinarily constructed being capable of carrying pressure measured in ounces.

The pipe 13 leads to the pipe 4, the pipe 4 being connected to the tank so that there is delivered to the tank by way of the gas connection gas sufficient to raise its pressure to the pre-determined pressure controlled by the valve 14. Through rising temperature added gas is added to the tank, or where the

liquid is added to the tank the pressure in the tank rises above that set by the valve 14 thus closing it. Under these circumstances a valve 25 is opened. This valve 25 is shown in detail in Fig. 9. It is provided with a body 26 having a partition 27 with a valve opening in its seat, the valves 28 operating on these seats, the stem 29 extending from the valve stem having guide wings 30 extending into a compartment 31 in which is arranged a diaphragm 32. The diaphragm is loaded by a spring 33 which operates against a head 34 which may be adjusted by a screw 35 so as to vary the strength of the spring and the pressure at which the valve will open.

As soon as the valve 25 opens gas under pressure is delivered past the valve by way of a pipe 4^a to a pump 36. This pump as shown is driven from an electric motor 37 by means of a belt 38. The motor is supplied through conductors 39 and 40 and these conductors are controlled by a switch 41. The switch 41 is of ordinary pressure controlled type and is connected by a pipe 42 with the pipe 4^a. With pressure in the pipe 4^a the switch 41 is closed and the motor 37 started, thus starting the pump and drawing gas from the tank. The pump should be of sufficient capacity to remove any gas that may accumulate through sudden rises in temperature. This, of course, is not ordinarily rapid by reason of the large volume of liquid. The pump should also be of sufficient capacity to take care of the gas as it is compressed through the filling of the tank with the liquid. The pump discharges through a pipe 36^a back to the gas supply or as may be desired. It will be noted that the valve 25 is spring actuated and consequently acts gradually, that is to say, if there is sufficient gas evolved or produced in the tank to maintain the pump in action the valve will partly open and allow a continued discharge during the production of the gas, or filling of the tank. If the pressure goes up slightly above this the valve is opened wider, or if the pressure drops the valve is closed somewhat thus permitting a flow to the pump corresponding to some extent to the amount of gas it is necessary to draw off the tank to maintain the pressure.

In the alternative construction shown in Fig. 3 the gas supply is delivered through a pipe 13 and passes through a valve 43 to the pipe 4. The valve 43 is shown in detail in Fig. 8. It comprises a body 44 with a diaphragm 45 having valve openings and seats, the valve 46 operating on these seats, the valve stem 47 extending from the valve, the stem being provided with the guide wings 48 and being controlled by a diaphragm 49. The diaphragm is loaded through a push pin 50 by a weighted lever 51. The inlet is at 52 and the outlet at 53. It will be noted that the valve 43 is the same in detail as the valve 14 and closes when a pre-determined pressure is delivered to the tank. The pipe 4 is provided with a valve 4^b so that the connection may be shut off if desired particularly when gauging the tank. The valve 54 is shown in detail in Fig. 9 and is exactly similar to the valve 25 operating in the same manner opening when the pressure in the tank rises above a predetermined pressure and permitting the excess to flow to the pipe 55 where it is delivered to the pump 36 in the same manner as in the construction shown in Fig. 1. The control switch is operated in the same manner. When the valve 54 closes and a vacuum is created in the intake the switch is opened shutting down the electric motor and when the pressure is delivered to the pipe 55 the switch is closed starting the electric motor and the pump.

In the alternative construction shown in Fig. 5 gas is delivered to the pipe 13 at a pressure below that desired for the tank and the pressure, therefore, is boosted by the pump. The pump 36 is connected by the pipe 36^a with the pipe 4, the gas passing through a regulating valve 58 corresponding to the valve 25 and operating in the same manner. A bypass 59 extends from the pipe 36^a to the pipe 13 and a valve 63 is controlled by the pressure in this bypass. The valve 63 is shown in detail in Fig. 7. The pipe 61 connects with the pipe 59 and is connected to the diaphragm chamber 62. A diaphragm 64 is arranged in the chamber and subjected to the pressure from the pump. A valve stem 65 extends from the diaphragm being guided by the wings 66 and a valve 67 is attached to the stem and controls the passage through the valve 63. A spring 68 opposes the pressure of the diaphragm so that the valve 63 is open except when the diaphragm 64 is subjected to pressure. When the valve 63 is open there is sufficient pressure in the pipe 13^a between the valve 63 and the pump which communicated to the pressure-actuated switch will close the circuit and start the motor. The pump will continue in action delivering through the valve 58 until the tank has its pre-determined pressure. The continued action of the pump builds up pressure in the pipe 36^a and 59 and this is communicated through the pipe 61 to the diaphragm cutting off the the valve 63, when the continued action of the pump creating a vacuum in the intake results in the opening of the pressure-controlled switch 41, thus shutting off the motor and shutting down the pump. As a safety feature a pressure valve 60 is provided which is controlled by pressure from the intake. This valve is similar to the valve 25 and opens at a pressure above that of the valve 58. It returns the surplus gas to the line.

A pipe 69 connects the pipe 4 with the pipe 13 and is controlled by a valve 70. This valve 70 is controlled by its intake or tank pressure and is similar in structure to the valve 25 except that it is loaded to operate at a pressure slightly above the pressure at which the valve 58 operates so that after the valve 58 closes if there is a pressure created in the tank it is relieved through the valve 70.

It is preferable to condense the gasoline from the gas which is drawn from the tank. Ordinarily such gas would be largely gas that has evaporated from the oil or gasoline in the tank so that it can be readily condensed if there is no air or other ingredient in it to the liquid state. I prefer, therefore, to lead the pipe 36^a under these conditions to a coil 71 which is cooled from a spray 72. The liquid condensed is carried to a trap 73 and discharged as the trap fills through a pipe 74 which leads into the tank and is provided with a distributing pipe 75, the purpose of distributing the condensate or gasoline being to bring it into more general contact with the heavier constituents of the liquid in the tank so that it may be absorbed thereby and retained. The discharge to the pipe 74 is controlled by a valve 76, this valve being arranged in a body 77, the valve stem 78 having an opening 79 through it into which an arm 80 of a bell crank lever extends, the other arm of the bell crank lever being provided with a float 81 which rises with the gasoline to open the valve and falls as the gasoline falls to close the valve. A gas pipe 82 leads from the trap and can be carried back to the gas connection or to the air as desired. A relief valve 44 is mounted on the pipe 82 and opens to the discharge with a pre-determined pressure in the trap. The valve is of the ordinary control type being responsive to pressure in the trap. The valve is shown in Fig. 8 and is provided with a body 44^a, a diaphragm 45 having valve passages and seats, valve discs 46, stem 47, guide wings 48 and diaphragm 49 connected to the stem, push pin 50 operating against the diaphragm and a weighted lever 51 on the push pin. The gas enters at 52 and is discharged at 53.

Where a tank is carrying oil and there would be no purpose in returning the gasoline to the tank the gasoline may be delivered to a pipe 74^a and controlled by a three-way valve 83. The gasoline from the trap under these conditions is carried by a pipe 84 to a gasoline storage where gasoline is stored so that if it is desired to return it to the tank the valve is turned so as to connect the pipe 74^a with a continuation of the pipe 74 leading back to the storage tank.

I prefer to provide the intake 2 with transparent plates 2^a furnishing an opportunity for observing the flow of oil to the tank without opening the tank.

It will be noted that the air discharge pipe 9 extends through a stuffing box 9^a so that it may be raised and lowered and thus bring the bottom end just above the level of the oil. With this adjustment as the gas is delivered to the tank the air being heavier remains near the oil and is finally discharged without co-mingling to any injurious extent with the incoming gas.

It will be noted that the intake discharges the oil near the bottom of the tank and leading from the top of the tank the pipe will be empty as the flow stops so that the sight will indicate the feed. This manner of discharge permits of the oil in the tank absorbing the lighter constituents of the oil as they rise in the body of the oil at rest. Quite a large proportion of these lighter constituents are lost where the oil is delivered to the tank from near the top in an unconfined state. It will be noted also that the sight opening is larger than the intake pipe so as to give a clearer indication of the ingoing oil.

What I claim as new is:—

1. The method of treating oil and its constituents which consists in holding the same in a closed receptacle, delivering and drawing off gas from the receptacle to maintain the oil under pressure of gas above atmosphere, condensing the liquid from the gas removed, and returning the liquid to the receptacle.

2. The method of treating oil and its constituents which consists in holding the same in a closed receptacle, delivering and drawing off gas from the gasoline to maintain the oil under pressure of gas above atmosphere, condensing the liquid from the gas removed and returning the liquid to the receptacle, and distributing the same through the liquid in the receptacle.

3. In an apparatus for treating oil and its constituents the combination of a tank; a gas supply connected with the tank; a pump connected with the tank; and controlling devices acting on the supply connection and pump to deliver and draw off gas from the tank to maintain a constant pressure on the tank above atmosphere.

4. In an apparatus for treating oil and its constituents the combination of a tank; a gas supply connected with the tank; a pump connected with the tank; controlling devices acting on the supply connection and pump to deliver and draw off gas from the tank to maintain a constant pressure on the tank; and means for condensing a liquid from the gas drawn off and for returning the same to the tank.

5. In an apparatus for treating oil and its constituents the combination of a tank; a connection leading a gas supply to the

tank; a valve responsive to tank pressure above atmosphere controlling said connection; and means for drawing off excess gases.

6. In an apparatus for treating oil and its constituents the combination of a tank; a connection leading a gas supply to the tank, said connection delivering gas to the top of the tank and in a direction to avoid draft disturbance of the gases in the tank; a valve responsive to tank pressure above atmosphere controlling said connection; and means for drawing off excess gases.

7. In an apparatus for treating oil and its constituents the combination of a tank; a connection leading a gas supply to the tank; a valve responsive to tank pressure above atmosphere controlling said connection; means for drawing off excess gases; and a pressure valve responsive to tank pressure controlling the means.

8. In an apparatus for treating oil and its constituents the combination of a tank; a connection leading a gas supply to the tank; a valve responsive to tank pressure above atmosphere controlling said connection; and means for drawing off excess gases comprising a pump.

9. In an apparatus for treating oil and its constituents the combination of a tank; a connection leading a gas supply to the tank; a valve responsive to tank pressure above atmosphere controlling said connection; means for drawing off excess gases comprising a pump; and a pressure valve between the pump and tank responsive to tank pressures controlling the connection to the pump.

10. In an apparatus for treating oil and its constituents the combination of a tank; a connection leading a gas supply to the tank; a valve responsive to tank pressure above atmosphere controlling said connection; means for drawing off excess gases comprising a pump; and means responsive to variations of tank pressure for automatically starting and stopping the pump.

11. In an apparatus for treating oil and its constituents the combination of a tank; a connection leading a gas supply to the tank; a valve responsive to tank pressure above atmosphere controlling said connection; means for drawing off excess gases comprising a pump; and means responsive to pressures between the valve and the pump for varying the action of the pump.

12. In an apparatus for treating oil and its constituents the combination of a tank; means for connecting a gas supply to said tank; a pressure valve responsive to pressures in the tank controlling said supply and controlling a delivery of gas above atmospheric pressure; a pump; a connection between the pump and tank; a valve controlling the connection between the pump and the tank operating when the pressure of the tank rises above the pressure at which the first-mentioned valve acts; and means for starting the pump upon the opening of the last-mentioned valve.

13. In an apparatus for treating oil and its constituents the combination of a tank; means for connecting a gas supply to said tank; a pressure valve responsive to pressures in the tank controlling said supply and controlling a delivery of gas above atmospheric pressure; a pump; a connection between the pump and tank; a valve controlling the connection between the pump and the tank operating when the pressure of the tank rises above the pressure at which the first-mentioned valve acts; and means for starting the pump upon the opening of the last-mentioned valve comprising a pressure-actuated switch.

14. In an apparatus for treating oil and its constituents the combination of a tank; a test tube leading into the tank; means for delivering gas under pressure to the tank; a pressure valve responsive to pressures in the tank controlling said means; a cut-off valve; means for drawing the excess pressure from the tank; and means for opening and closing the test tube.

15. In an apparatus for treating oil and its constituents the combination of a tank; means for delivering and withdrawing the gas from said tank to maintain a gas pressure on the tank above atmosphere; means for condensing a liquid from the gas withdrawn; and means for returning the liquid condensed to the tank.

16. In an apparatus for treating oil and its constituents the combination of a tank; an adjustable air discharge pipe extending into the tank; and means for supplying a gas to the tank above the air.

17. In an apparatus for treating oil and its constituents the combination of a tank; an air discharge pipe extending into the tank; and means for supplying a gas to the tank above the air in a direction to avoid a disturbance of the gaseous contents.

18. The method of treating oil and its constituents which consists in holding the same in a closed receptacle, delivering and drawing off gaseous fluid from the receptacle to maintain the oil under pressure of gaseous fluid above atmosphere, condensing the liquid from any gas removed, and returning the liquid to the receptacle.

19. The method of holding, storing, treating and moving oil and its constituents, which consists in holding a large volume of oil in a closed receptacle, delivering and withdrawing the oil from the receptacle, and delivering and drawing off gaseous fluid from the receptacle to maintain the oil under

pressure of the said fluid above atmosphere.

20. The method of holding, storing, treating and moving oil and its constituents, which consists in holding a large volume of oil in a closed receptacle, delivering and withdrawing the oil from the receptacle, and delivering and drawing off from the receptacle a hydrocarbon gas similar to the gas evolved by the oil stored to maintain the oil under pressure of the gas above atmosphere.

In testimony whereof I have hereunto set my hand.

RUDOLPH CONRADER.